CHAPTER 4: RESULTS

4.1 Prevalence of Antimicrobial Resistance Genes

4.1.1 Monoplex PCR detection of antimicrobial resistance genes

The antimicrobial resistance genes, including *bla*$_{TEM}$ (859bp), *bla*$_{PSE-1}$ (438bp), *bla*$_{SHV}$ (795bp), *bla*$_{CTX-M}$ (593bp), *bla*$_{OXA-1}$ (813bp), *bla*$_{CMY-2}$ (758bp), *qnrA* (580bp), *qnrB* (264bp), and *qnrS* (428bp) were amplified individually. Different antimicrobial resistance genes were detected and are shown in Figure 4.1.1 to Figure 4.1.9.

4.1.1.1 Detection of *bla*$_{TEM}$ gene

According to the PCR results, strains that were resistant to ampicillin do not necessarily harbor amplicon of *bla*$_{TEM}$ because not all ampicillin-resistant strains harbored this gene. Nine of 18 ampicillin-resistant strains gave amplicon of *bla*$_{TEM}$ (859bp), including *S.* Lagos (SLG B1 and SLG B32), *S.* Enteritidis (SE 16/07 and SE 18/07), *S.* Farsta (SFS B5 and SFS B36), *S.* Typhimurium (STM 06/08 and STM 47/07), *S.* Bovismorbificans (SBV 56/07). Representative gels of *bla*$_{TEM}$ gene detection are shown in Figure 4.1.1. The amplicon of SE 16/07 was sequenced and demonstrated 99% sequence identity to S. Enteritidis plasmid pUO-SeVR1 (GenBank accession no. FN995456.1). The blast result is shown in Appendix 5. Thus, SE 16/07 was used as positive control for *bla*$_{TEM}$ (859bp) gene detection.

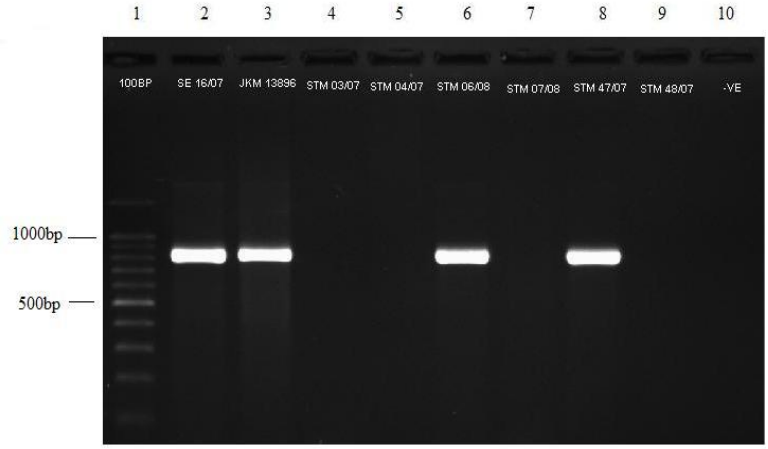

Figure 4.1.1: Representative gel of *bla*$_{TEM}$ (859bp) gene detection.

Lane 1: 100bp marker (Promega); lane 2: SE 16/07;

lane 4: STM 03/07; lane 5: STM 04/07; lane 6: STM 06/08;

lane 7: STM 07/08; lane 8: STM 47/07;

lane 9: STM 48/07; lane 10: Negative control

bla$_{TEM}$ gene is not detected in lane 4, 5, 7 and 9 because

these strains do not resistant to ampicilin.

4.1.1.2 Detection of *bla*$_{PSE-1}$ gene

From the results, five of 18 ampicillin-resistant strains gave amplicon of *bla*$_{PSE-1}$ (438bp), including *S.* Albany (SAB 53/07), *S.* Paratyphi B (SPB 05/08, SPB 06/08, and SPB 07/08) and *S.* Limete (SLM B37). Representative gel of *bla*$_{PSE-1}$ detection is shown in Figure 4.1.2. The amplicon of SPB 07/08 was sequenced and demonstrated 99% sequence identity to *Salmonella* enterica subsp. enterica serovar Paratyphi B (GenBank accession no. HQ132377.1).The blast result is shown in Appendix 6. Therefore, SPB 07/08 was used as positive control for *bla*$_{PSE-1}$ (438bp) gene detection.

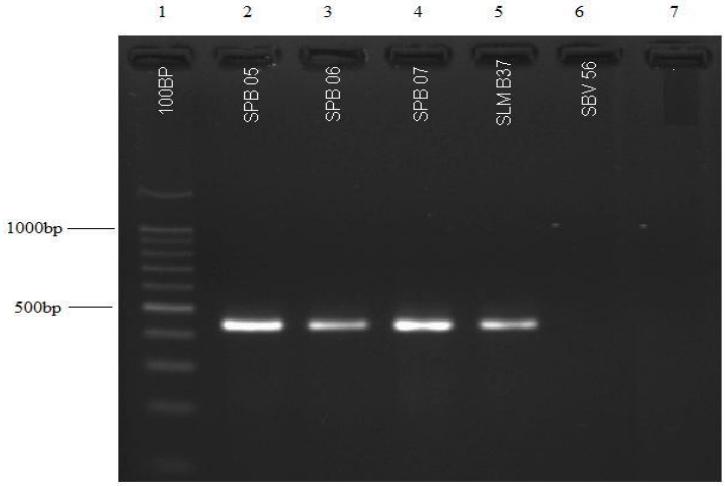

Figure 4.1.2: Representative gel of *bla*$_{PSE-1}$ (438bp) gene detection.

Lane 1: 100bp marker; lane 2: SPB 05/08; lane 3: SPB 06/08;

lane 4: SPB 07/08; lane 5: SLM B37; lane 6: SBV 56/07;

lane 7: Negative control

bla$_{PSE-1}$ gene is not detected in lane 6 because this strain is harbored *bla*$_{TEM}$ (859bp) gene.

4.1.1.3 Detection of *bla*$_{SHV}$ gene

One of 36 strains (2.8 %) that was resistant to β-lactams harboured *bla*$_{SHV}$ (795 bp) which is *S.* Enteritidis (SE 20/08). Positive control used was *E. coli* EC35, which was sequenced and confirmed as *bla*$_{SHV}$ (Genbank accession no. CAI76927) in another study. Representative gels of *bla*$_{SHV}$ are shown in Figure 4.1.3.

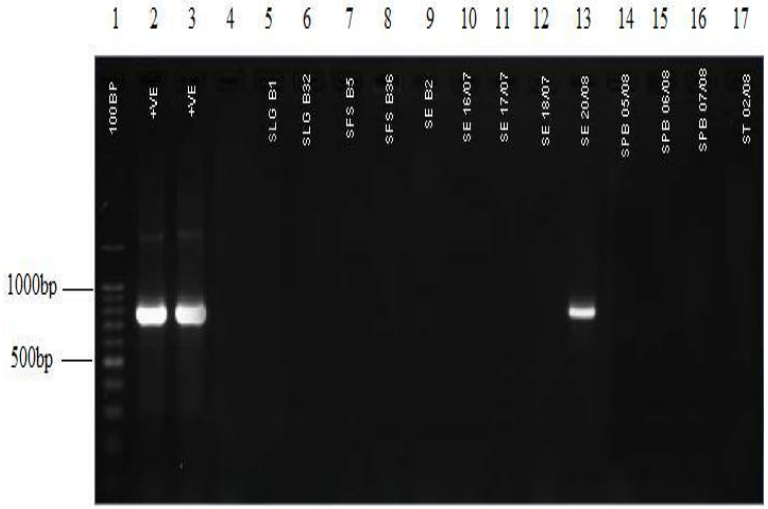

Figure 4.1.3: Representative gel of *bla*$_{SHV}$ (795 bp) gene detection.
Lane 1: 100 bp marker; lane 2: Positive control; lane 5: SLG B1;
lane 6: SLGB32; lane 7: SFS B5; lane 8: SFS B36; lane 9: SE B2;
lane 10: SE 16/07; lane 11: SE17/07; lane 12: SE 18/07;
lane 13: SE 20/08; lane 14: SPB 05/08; lane 15: SPB 06/08;
lane 16: SPB 07/08; lane 17: ST 02/08

bla$_{SHV}$ (795bp) gene was only detected in *S.* Enteritidis (SE 20/08) among strains that resistant to β-lactams.

4.1.1.4 Detection of *bla*$_{CTX-M}$ gene

bla$_{CTX-M}$ (593bp) was detected in 12 strains (33.3%) that were resistant to β-lactams. Those were *S.* Lagos (SLG B1 and SLG B32), *S.* Enteritidis (SE B2, SE 16/07, SE 17/07, and SE 18/07), *S.* Farsta (SFS B5 and SFS B36), *S.* Corvallis (SCV G1), *S.* Typhimurium (STM 07/08, STM 47/07, and STM 48/07). Representative gel of *bla*$_{CTX-M}$ detection is shown in Figure 4.1.4. The amplicon of SLG B1 was sequenced and demonstrated 99% sequence identity to *Salmonella* enterica subsp. enterica serovar Typhimurium strain B9903 plasmid insertion sequence ISEcp1 (GenBankk accession no. HM117627.1). The blast result is shown in Appendix7. Therefore, SLG B1 was used as the positive control for *bla*$_{CTX-M}$ (593bp) gene detection.

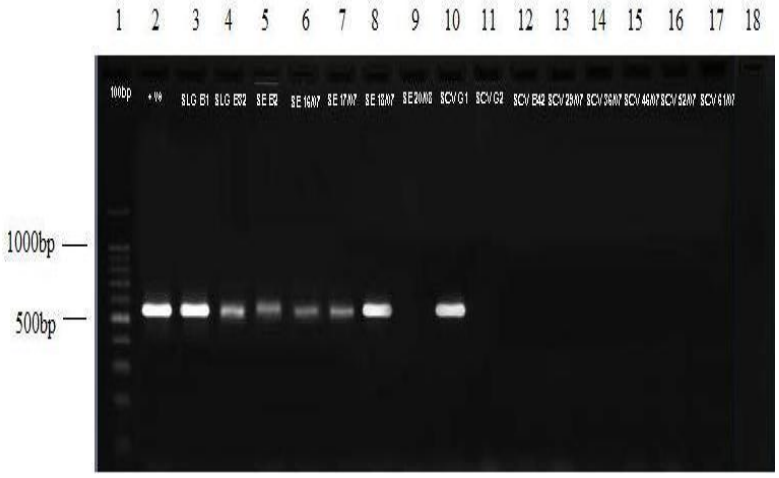

Figure 4.1.4: Representaitve gel of *bla*$_{CTX-M}$ (593bp) gene detection

Lane 1: 100bp marker (Promega); lane 3: SLG B1; lane 4: SLG B32;
lane 5: SE B2; lane 6: SE 16/07; lane 7: SE 17/07; lane 8: SE 18/07; lane 9: SE 20/08;
lane 10: SCV G1; lane 11: SCV G2; lane 12: SCV B42; lane 13: SCV 29/07;
lane 14: SCV 36/07; lane 15: SCV 46/07; lane 16: SCV 52/07; lane 17: SCV 61/07;
lane 18: Negative control

4.1.1.5 Detection of *bla*$_{OXA-1}$ gene

bla$_{OXA-1}$ (813bp) was not detected in 36 strains that were resistant to β-lactams. Representative gel is shown in Figure 4.1.5. Positive control used was *E. coli* EC7, which was sequenced and confirmed as *bla*$_{OXA-1}$ (Genbank accession no. NP_957554) previously in another study.

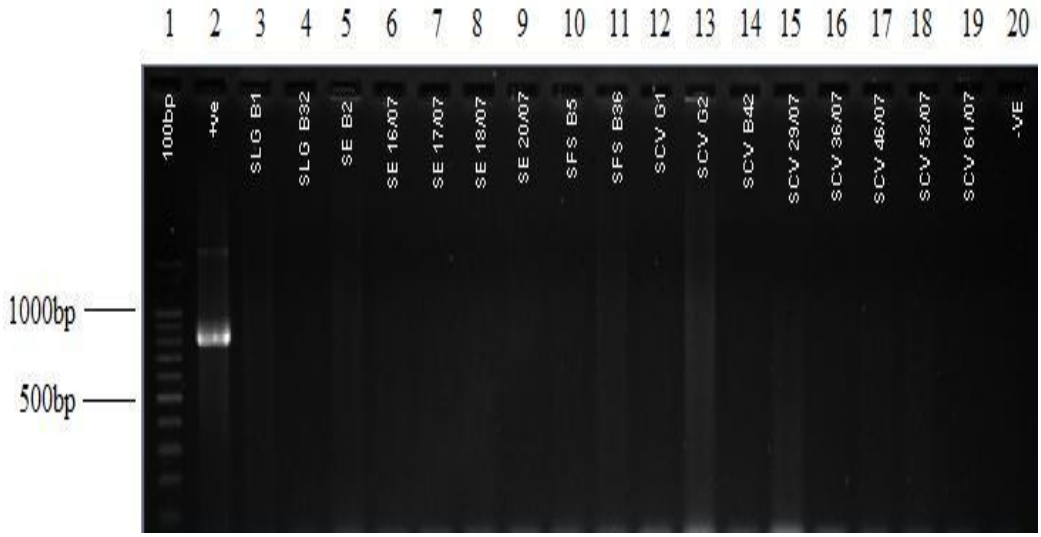

Figure 4.1.5: Representative gel of *bla*$_{OXA-1}$ (813bp) gene detection.

Lane1: 100bp marker (Promega); lane 2: Positive control; lane 3: SLG B1; lane 4: SLG B32; lane 5: SE B2; lane 6: SE 16/07; lane 7: SE 17/07; lane 8: SE 18/07; lane 9: SE 20/07; lane 10: SFS B5; lane 11: SFS B36; lane 12: SCV G1; lane 13: SCV G2; lane 14: SCV B42; lane 15: SCV 29/07; lane 16: SCV 36/07; lane 17: SCV 46/07; lane 18: SCV 52/07; lane 19: SCV 61/07; lane 20: Negative control

4.1.1.6 Detection of *bla*$_{CMY-2}$ gene

According to the results, *bla*$_{CMY-2}$ (758bp) was detected in three of 36 strains (8.3%) that were resistant to β-lactams, including *S.* Farsta (SFS B36), *S.* Corvallis (SCV 36/07) and *S.* Typhimurium (STM 06/08). Representative gels are shown in Figure 4.1.6. The amplicon of STM 06/08 was sequenced and demonstrated 100% sequence identity to *Salmonella* enterica subsp. enterica serovar Typhimurium plasmid pSTHV23035 (GenBank accession no. GQ398239.1). The blast result is shown in Appendix 8. Thus, STM 06/08 was used as positive control for *bla*$_{CMY-2}$ (758bp) gene detection.

Figure 4.1.6: Representative gel of *bla*$_{CMY-2}$ (758bp) gene detection
Lane 1: 100bp marker (Promega); lane 2: STM 06/08;
lane 3: SFS B36; lane 4: SCV 36/07
lane 5: Negative control

bla$_{CMY-2}$ (758bp) gene was detected in 3 strains that are STM 06/08, SFS B36 and SCV 36/07.

Occurrence of β-lactamase resistance genes amplified from MDR *Salmonella* strains are summarized in Table 4.1.1 and Table 4.1.2.

Table 4.1.1: Detection of β-lactamase resistance genes among selected MDR *Salmonella* strains that resistant to β-lactams

Strain	Serovar	Antibiogram	Resistance genes					
			bla_{TEM}	bla_{PSE-1}	bla_{CMY-2}	bla_{SHV}	bla_{CTX-M}	bla_{OXA-1}
SLG B1	Lagos	Amp,Ce,Cl,Cf,Cro,Cxm,Ctx	+	-	-	-	+	-
SLG B32	Lagos	Amp, C, S, Su,Gm, K, Tm, Sxt,Cf, Cip, Na	+	-	-	-	+	-
SE B2	Enteritidis	Tet, Ce, Cl, Cf, Cro, Cxm, Ctx	-	-	-	-	+	-
SE 17/07	Enteritidis	Tet, Cf	-	-	-	-	+	-
SE 20/08	Enteritidis	Tet, Cf, Sxt	-	-	-	+	-	-
SE 16/07	Enteritidis	Amp, Cf, Na	+	-	-	-	+	-
SE 18/07	Enteritidis	Amp, Cf, Tio, Ctx, Caz, Cro, Na	+	-	-	-	+	-
SFS B5	Farsta	Amp, C, S, Su, Gm, K, Tm, Sxt, Na	+	-	-	-	+	-
SFS B36	Farsta	Amp, S, Su, Tet, K, Ce, Cl, Cf, Cxm, Na	+	-	+	-	+	-
SAB B13	Albany	Amp, C, S, Su,Tet, K, Tm, Sxt, Na	-	-	-	-	-	-
SAB 53/07	Albany	Amp, C,Tet, Sxt, Cf, Na	-	+	-	-	-	-
SAB 57/07	Albany	Tet, Sxt, Cf, Na	-	-	-	-	-	-
SCV G1	Corvallis	Amp, Su, Tet,Tm, Sxt, Cl, Cf, Cxm	-	-	-	-	+	-
SCV G2	Corvallis	Amp, Su, Tet, Tm, Sxt, Ce, Cl, Cf, Cro, Cxm, Ctx	-	-	-	-	-	-
SCV 36/07	Corvallis	Amp, S, Tet, Cf, Caz, Tio, Amc	-	-	+	-	-	-
SCV B42	Corvallis	S, Su, Tet, Ce, Cl, Cf	-	-	-	-	-	-
SCV 52/07	Corvallis	S, Tet, Cf	-	-	-	-	-	-
SCV 61/07	Corvallis	S, Tet, Cf, Tio	-	-	-	-	-	-

Table 4.1.1: Continued.

Strain	Serovar	Antibiogram	Resistance genes					
			bla$_{TEM}$	*bla*$_{PSE-1}$	*bla*$_{CMY-2}$	*bla*$_{SHV}$	*bla*$_{CTX-M}$	*bla*$_{OXA-1}$
SCV 46/07	Corvallis	S, Tet, Cf, Na	-	-	-	-	-	-
SCV 33/07	Corvallis	S, Tet, Cip, Na	-	-	-	-	-	-
SCV 29/07	Corvallis	S, Tet, Tio,Na	-	-	-	-	-	-
SCV 38/07	Corvallis	S, Tet, Na	-	-	-	-	-	-
STM 06/08	Typhimurium	Amp, C, S, Tet, Gm, K, Sxt, Cf, Tio, Caz, Gat, Na, Amc	+	-	+	-	-	-
STM 47/07	Typhimurium	Amp, C, S, Tet, Gm, K, Sxt, An, Cf, Gat,Na	+	-	-	-	+	-
STM 03/07	Typhimurium	Cf, Na, Lvx	-	-	-	-	-	-
STM 04/07	Typhimurium	S, Tet, Sxt, Cf	-	-	-	-	-	-
STM 48/07	Typhimurium	S, Tet, Cf, Tio, Lvx, Gat, Na	-	-	-	-	+	-
STM 07/08	Typhimurium	Tio, Na	-	-	-	-	+	-
STM 30/07	Typhimurium	Tet, Gat	-	-	-	-	-	-
STAN 01/07	Stanley	Tet, Cf, Na	-	-	-	-	-	-
STAN 02/07	Stanley	S, K, Cf	-	-	-	-	-	-
SBR 49/07	Braenderup	Tet, K, Cf, Na	-	-	-	-	-	-
SBR 75/08	Braenderup	S,Tet, Gat	-	-	-	-	-	-
SPB 05/08	Paratyphi B var Java	Amp, C, S, Tet	-	+	-	-	-	-
SPB 06/08	Paratyphi B var Java	Amp, C, S, Tet, An	-	+	-	-	-	-
SPB 07/08	Paratyphi B var Java	Amp, C, S, Tio	-	+	-	-	-	-
SEP B3	Ependorf	Ce,Cl,Cro,Cxm	-	-	-	-	-	-
SLM B37	Limete	Amp, C, S, Su, Tet, Tm, Sxt, Ce, Cl, Cf, Cip, Na	-	+	-	-	-	-
ST 02/08	Typhi	Cf, Na	-	-	-	-	-	-
SMU 31/07	Muenchen	Tet, Na	-	-	-	-	-	-
SBV 56/07	Bovismorbificans	Amp, C, S, Tet, K, Sxt, Cf	+	-	-	-	-	-

Amp, ampicillin; C, chloramphenicol; Tet, tetracycline; S, streptomycin; Su, sulfonamides; An, amikacin; K, kanamycin; Gm, gentamicin, Amc, amoxicillin/clavulanic acid,Tm, trimethoprim; Na, nalidixic acid, Cip, ciprofloxacin; Gat, gatifloxacin; Lvx, levofloxacin; Sxt, trimethoprim-sulfamethoxazole; Ce, cephradine; Cl, cephalexin; Cf, cephalothin; Cxm, cefuroxime; Caz, ceftazidime; Cro, ceftriaxone; Ctx, cefotaxime; Tio, ceftiofur; (+): present; (-): absent

Table 4.1.2: Occurrence of β-lactamase resistance genes among selected MDR *Salmonella* strains that resistant to β-lactams

β-lactamase resistance Genes Detected	Number of Strains (%)
bla_{TEM}	9 (25.0%)
$bla_{\text{PSE-1}}$	5 (13.9%)
bla_{SHV}	1 (2.8%)
$bla_{\text{CTX-M}}$	12 (33.3%)
$bla_{\text{OXA-1}}$	0 (0%)
$bla_{\text{CMY-2}}$	3 (8.3%)

4.1.1.7 Detection of *qnrA* gene

From the results, *qnrA* (580bp) gene was not detected in strains that were resistant to fluoroquinolones. Representative gel is shown in Figure 4.1.7. Strain (J53A) that provided by George A. Jacoby was used as positive control.

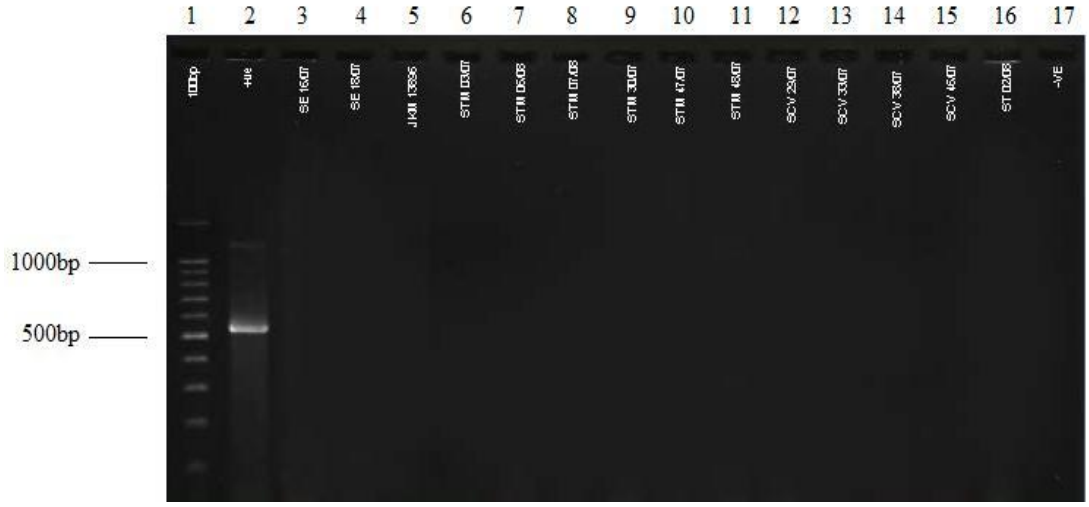

Figure 4.1.7: Representative gel of *qnrA* (580bp) gene detection.
Lane 1: 100bp marker (Promega); lane 2: Positive control;
lane 3: SE 16/07; lane 4: SE 18/07; lane 5: JKM 13896 (STM 002/07);
lane 6: STM 03/07; lane 7: STM 06/08; lane 8: STM 07/08;
lane 9: STM 30/07;lane 10: STM 47/07; lane 11: STM 48/07;
lane 12: SCV 29/07; lane 13: SCV 33/07; lane 14: SCV 38/07;
lane 15: SCV 46/07; lane 16: ST 02/08; lane 17: Negative control

4.1.1.8 Detection of *qnrB* gene

According to the results, *qnrB* (264bp) gene was found in 18 of 24 strains (75.0%) that were resistant to fluoroquinolones. These strains include serovars of Lagos (SLG B32), Enteritidis (SE 16/07, SE 18/07), Farsta (SFS B5, SFS B36), Albany (SAB 57/07), Corvallis (SCV 29/07, SCV 33/07, SCV 38/07, SCV 46/07), Typhimurium (STM 06/08, STM 07/08, STM 30/07, STM 47/07, STM 48/07), Braenderup (SBR 49/07, SBR 75/08), and Muenchen (SMU 31/07). Representative gel is shown in Figure 4.1.8. Strain (J53B) that provided by George A. Jacoby was used as positive control.

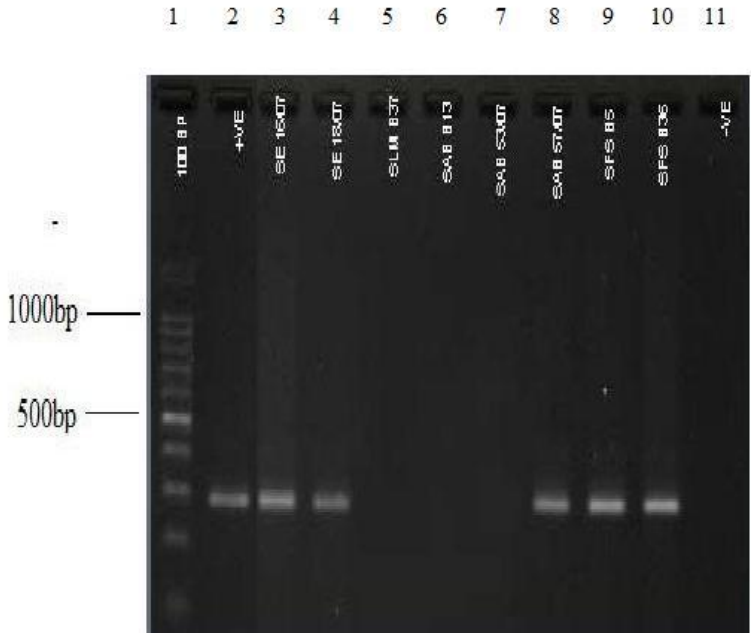

Figure 4.1.8: Representative gel of *qnrB* (264bp) gene detection.
Lane 1: 100bp marker (Promega); lane 2: Positive control;
lane 3: SE 16/07; lane 4: SE 18/07; lane 5: SLM B37;
lane 6: SAB B13; lane 7: SAB 53/07; lane 8: SAB 57/07;
lane 9: SFS B5; lane 10: SFSB36; lane 11: Negative control

4.1.1.9 Detection of *qnrS* gene

From the results, *qnrS* gene was detected in seven of 24 strains (29.2%) that were resistant to fluoroquinolones. These strains were serovars of Lagos (SLG B32), Farsta (SFS B5 and SFS B36), Corvallis (SCV 29/07), and Typhimurium (STM 07/08, STM 30/07, and STM 47/07). Representative gel is shown in Figure 4.1.9.The amplicon of SLG B32 was sequenced and demonstrated 100% sequence identity to *Salmonella* enterica subsp. enterica strain 382/03 plasmid IncN (GenBank accession no. EU715253). The blast result is shown in Appendix 9. Therefore, SLG B32 was used as positive control.

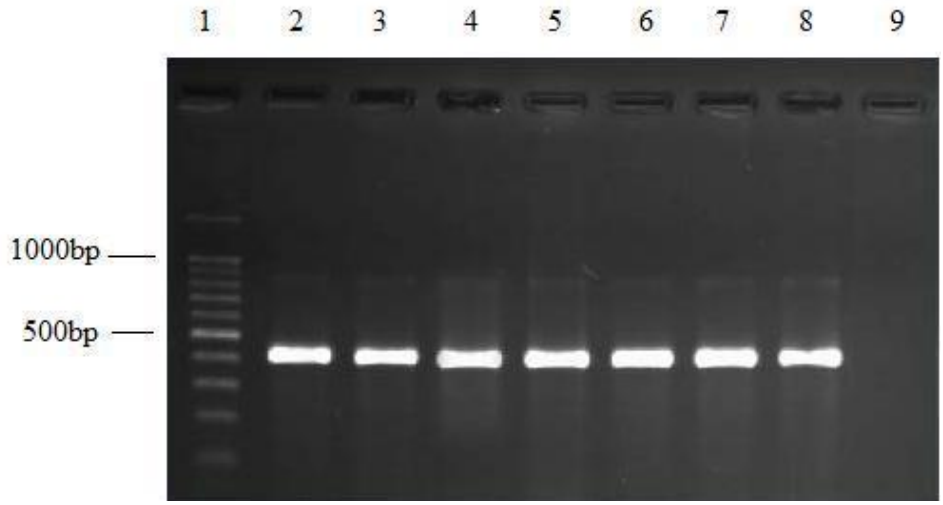

Figure 4.1.9: Representative gel of *qnrS* (428bp) gene detection.
Lane 1: 100 bp marker (Promega); lane 2: SLG B32; lane 3: SFS B5;
lane 4: SFS B36; lane 5: SCV 29/07; lane 6: STM 07/08; lane 7: STM 30/07;
lane 8: STM 47/07; lane 9: Negative control

Occurrence of fluoroquinolones resistance genes amplified from MDR *Salmonella* strains are summarized in Table 4.1.3 and Table 4.1.4.

Table 4.1.3: Detection of fluoroquinolones resistance genes among selected MDR *Salmonella* strains that resistant to fluoroquinolone

Strain	Serovar	Antibiogram	Resistance genes		
			qnrA	*qnrB*	*qnr S*
SLG B1	Lagos	Amp,Ce,Cl,Cf,Cro,Cxm,Ctx	-	-	-
SLG B32	Lagos	Amp, C, S, Su,Gm, K, Tm, Sxt,Cf, **Cip, Na**	-	+	+
SE B2	Enteritidis	Tet, Ce, Cl, Cf, Cro, Cxm, Ctx	-	-	-
SE 17/07	Enteritidis	Tet, Cf	-	-	-
SE 20/08	Enteritidis	Tet, Cf, Sxt	-	-	-
SE 16/07	Enteritidis	Amp, Cf, **Na**	-	+	-
SE 18/07	Enteritidis	Amp, Cf, Tio, Ctx, Caz, Cro, **Na**	-	+	-
SFS B5	Farsta	Amp, C, S, Su, Gm, K, Tm, Sxt, **Na**	-	+	+
SFS B36	Farsta	Amp, S, Su, Tet, K, Ce, Cl, Cf, Cxm, **Na**	-	+	+
SAB B13	Albany	Amp, C, S, Su,Tet, K, Tm, Sxt, **Na**	-	-	-
SAB 53/07	Albany	Amp, C,Tet, Sxt, Cf, **Na**	-	-	-
SAB 57/07	Albany	Tet, Sxt, Cf, **Na**	-	+	-
SCV G1	Corvallis	Amp, Su, Tet,Tm, Sxt, Cl, Cf, Cxm	-	-	-
SCV G2	Corvallis	Amp, Su, Tet, Tm, Sxt, Ce, Cl, Cf, Cro, Cxm, Ctx	-	-	-
SCV 36/07	Corvallis	Amp, S, Tet, Cf, Caz, Tio, Amc	-	-	-
SCV B42	Corvallis	S, Su, Tet, Ce, Cl, Cf	-	-	-
SCV 52/07	Corvallis	S, Tet, Cf	-	-	-
SCV 61/07	Corvallis	S, Tet, Cf, Tio	-	-	-
SCV 46/07	Corvallis	S, Tet, Cf, **Na**	-	+	-
SCV 33/07	Corvallis	S, Tet, Cip, **Na**	-	+	-
SCV 29/07	Corvallis	S, Tet, Tio, **Na**	-	+	+
SCV 38/07	Corvallis	S, Tet, **Na**	-	+	-

Table 4.1.3: Continued.

Strain	Serovar	Antibiogram	Resistance genes		
			qnrA	*qnrB*	*qnr S*
STM 06/08	Typhimurium	Amp, C, S, Tet, Gm, K, Sxt, Cf, Tio, Caz, **Gat, Na**, Amc	-	+	-
STM 47/07	Typhimurium	Amp, C, S, Tet, Gm, K, Sxt, An, Cf, **Gat, Na**	-	+	+
STM 03/07	Typhimurium	Cf, **Na, Lvx**	-	-	-
STM 04/07	Typhimurium	S, Tet, Sxt, Cf	-	-	-
STM 48/07	Typhimurium	S, Tet, Cf, Tio, **Lvx, Gat, Na**	-	+	-
STM 07/08	Typhimurium	Tio, **Na**	-	+	+
STM 30/07	Typhimurium	Tet, **Gat**	-	+	+
STAN 01/07	Stanley	Tet, Cf, **Na**	-	-	-
STAN 02/07	Stanley	S, K, Cf	-	-	-
SBR 49/07	Braenderup	Tet, K, Cf, **Na**	-	+	-
SBR 75/08	Braenderup	S,Tet, **Gat**	-	+	-
SPB 05/08	Paratyphi B var Java	Amp, C, S, Tet	-	-	-
SPB 06/08	Paratyphi B var Java	Amp, C, S, Tet, An	-	-	-
SPB 07/08	Paratyphi B var Java	Amp, C, S, Tio	-	-	-
SEP B3	Ependorf	Ce,Cl,Cro,Cxm	-	-	-
SLM B37	Limete	Amp, C, S, Su, Tet, Tm, Sxt, Ce, Cl, Cf, **Cip, Na**	-	-	-
ST 02/08	Typhi	Cf, **Na**	-	-	-
SMU 31/07	Muenchen	Tet, **Na**	-	+	-
SBV 56/07	Bovismorbificans	Amp, C, S, Tet, K, Sxt, Cf	-	-	-

Amp, ampicillin; C, chloramphenicol; Tet, tetracycline; S, streptomycin; Su, sulfonamides; An, amikacin; K, kanamycin; Gm, gentamicin, Amc, amoxicillin/clavulanic acid,Tm, trimethoprim; Na, nalidixic acid, Cip, ciprofloxacin; Gat, gatifloxacin; Lvx, levofloxacin; Sxt, trimethoprim-sulfamethoxazole; Ce, cephradine; Cl, cephalexin; Cf, cephalothin; Cxm, cefuroxime; Caz, ceftazidime; Cro, ceftriaxone; Ctx, cefotaxime; Tio, ceftiofur; (+): present; (-): absent

Table 4.1.4: Occurrence of fluoroquinolones resistance genes among selected MDR *Salmonella* strains

Fluoroquinolones Genes Detected	Number of Strains (%)
qnrA	0 (0%)
qnrB	18 (75.0%)
qnrS	7 (29.2%)

4.2 Detection of Class 1 Integron-encoded integrase and Class 1 Integron

4.2.1 Detection of Class 1 Integron-encoded integrase

All 41 MDR *Salmonella* strains were screened for the presence of class 1 integron-encoded integrase, *intI1*. Thirteen (31.7%) of 41 strains were positive for *intI1* suggesting the presence of class 1 integron in these strains. These strains were *Salmonella* serovar of Lagos (SLG B32), Farsta (SFS B5, SFS B36), Albany (SAB B13, SAB 53/07, SAB 57/07), Corvallis (SCV G1), Typhimurium (STM 06/08), Paratyphi B (SPB 05/08, SPB 06/08, SPB 07/08), Limete (SLM B37) and Bovismorbificans (SBV 56/07). Representative gel is shown in Figure 4.2.1. Strain of *E. coli* EC4 was used as positive control, which was sequenced and confirmed as *intI1* (GenBank accession no. NP_863006) from another study.

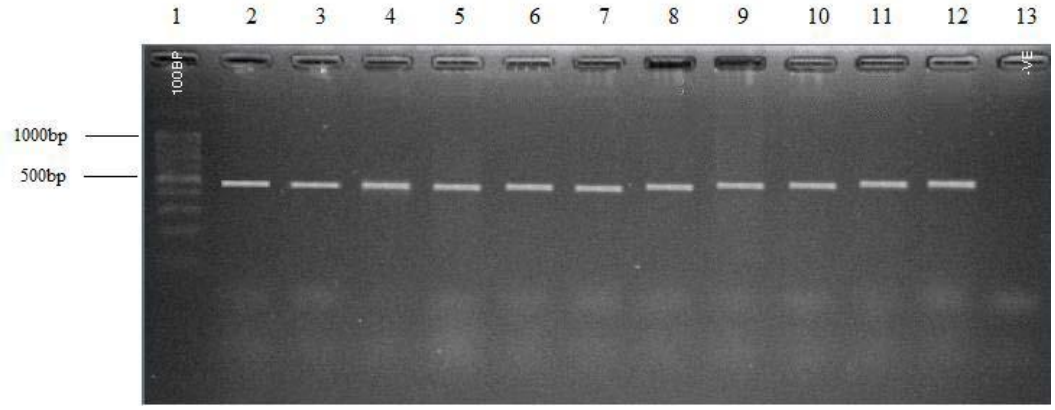

Figure 4.2.1: Representative gel of *int1* detection.

Lane 1: 100bp marker (Promega); lane 2: Positive control; lane 3: SAB B13; lane 4: SAB 53/07; lane 5: SAB 57/07; lane 6: SCV G1; lane 7: STM 06/08; lane 8: SPB 05/08; lane 9: SPB 06/08; lane 10: SPB 07/08; lane 11: SLM B37; lane 12: SBV 56/07; lane 13: Negative control

4.2.2 Detection of Class 1 Integron

Nine amplicons were detected in the following strains, SAB B13, SAB 53/07, SCV G1, STM 06/08, SPB 05/08, SPB 06/08, SPB 07/08, SLM B37, and SBV 56/07 with different sizes ranging from 1000bp to 1821 bp (Figure 4.2.2). No amplified product was obtained in another four *intI1*-positive strains (SLG B32, SFS B5, SFS B36 and SAB 57/07) where differences in CS region may prevent their amplification using the 5'CS/3'CS primer pair.

After purification, amplicons were sequenced by using the same primers as previously mentioned. The results of the DNA sequence data were compared to the data in the GenBank Database by using the BLAST algorithm available at the following website (http://blast.ncbi.nlm.nih.gov/Blast.cgi).

The occurrence of *int1* and class 1 integron is summarized in Table 4.2.1 and the blast results of class 1 integrons are shown in Table 4.2.2. Class 1 integron with 1000bp present in SPB 05/08, SPB 06/08 and SPB 07/08 also showed that it harbored *aadA2* gene which confers resistance to aminoglycosides. Besides, class 1 integrons found in SBV 56/07, STM 06/08, and SCV G1 were harbored similar resistance genes cassettes, which are *dfrA12* and *aadA2*. *dfrA12* confers resistance to trimethoprim. Class 1 integron of 1145bp (SLM B37) harbored *dfrA1* and *catB3* genes which confers resistance to chloramphenicol. Besides, class 1 integron of 1267bp found in SAB B13, harbored a *dfrA1* and *orfC* gene which is a hypothetical protein that has unknown function. Lastly, class 1 integron of 1245bp from SAB 53/07 harbored a $bla_{\text{PSE-1}}$ gene that confers resistance to ampicillin.

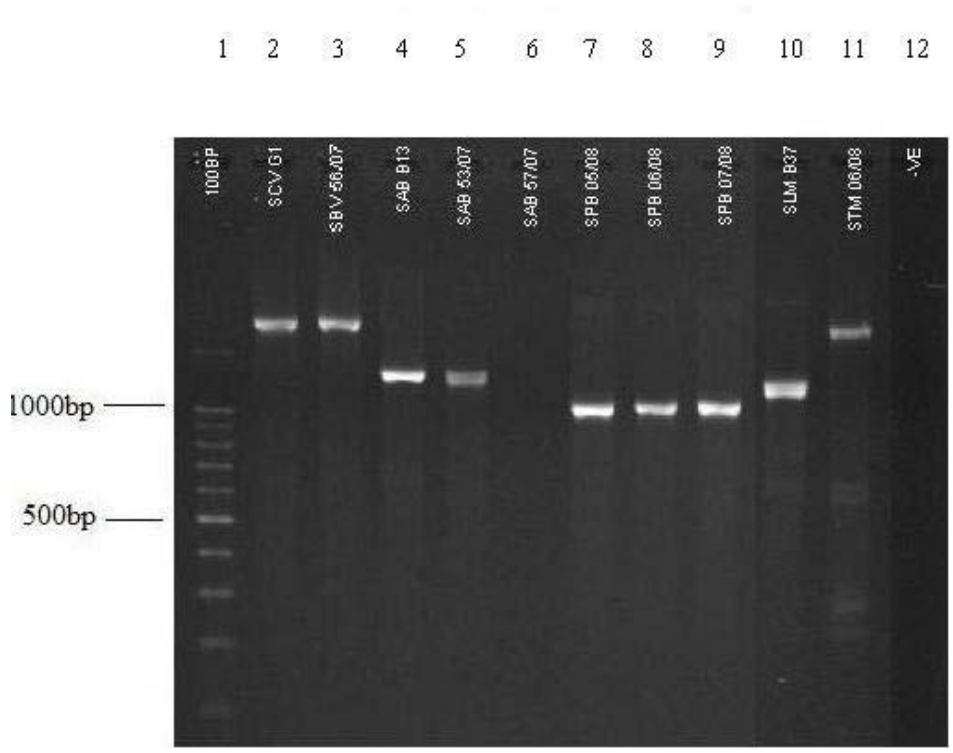

Figure 4.2.2: Representative gel of Class 1 Integron detection.

Lane 1: 100 bp marker (Promega); lane 2: SCV G1;

lane 3: SBV 56/07; lane 4: SAB B13; lane 5: SAB 53/07;

lane 6: SAB 57/07; lane 7: SPB 05/08; lane 8: SPB 06/08;

lane 9: SPB 07/08; lane 10: SLM B37; lane 11: STM 06/08;

lane 12: Negative control

Table 4.2.1: Gene of *int1* and class 1 integron amplified from the selected MDR *Salmonella* strains

Strains	Serovar	Antibiogram	*int1*	Class 1 integron	Size (bp)
SLG B1	Lagos	Amp,Ce,Cl,Cf,Cro,Cxm,Ctx	-	-	-
SLG B32	Lagos	Amp, C, S, Su,Gm, K, Tm, Sxt,Cf, Cip, Na	+	-	-
SE B2	Enteritidis	Tet, Ce, Cl, Cf, Cro, Cxm, Ctx	-	-	-
SE 16/07	Enteritidis	Amp, Cf, Na	-	-	-
SE 17/07	Enteritidis	Tet, Cf	-	-	-
SE 18/07	Enteritidis	Amp, Cf, Tio, Ctx, Caz, Cro, Na	-	-	-
SE 20/08	Enteritidis	Tet, Cf, Sxt	-	-	-
SFS B5	Farsta	Amp, C, S, Su, Gm, K, Tm, Sxt, Na	+	-	-
SFS B36	Farsta	Amp, S, Su, Tet, K, Ce, Cl, Cf, Cxm, Na	+	-	-
SAB B13	Albany	Amp, C, S, Su,Tet, K, Tm, Sxt, Na	+	*dfrA1*,orfC	1267
SAB 53/07	Albany	Amp, C,Tet, Sxt, Cf, Na	+	$bla_{\text{PSE-1}}$	1245
SAB 57/07	Albany	Tet, Sxt, Cf, Na	+	-	-
SCV G1	Corvallis	Amp, Su, Tet,Tm, Sxt, Cl, Cf, Cxm	+	*dfrA12,aadA2*	1821
SCV G2	Corvallis	Amp, Su, Tet, Tm, Sxt, Ce, Cl, Cf, Cro, Cxm, Ctx	-	-	-
SCV B42	Corvallis	S, Su, Tet, Ce, Cl, Cf	-	-	-
SCV 29/07	Corvallis	S, Tet, Tio,Na	-	-	-
SCV 33/07	Corvallis	S, Tet, Cip, Na	-	-	-
SCV 36/07	Corvallis	Amp, S, Tet, Cf, Caz, Tio, Amc	-	-	-
SCV 38/07	Corvallis	S, Tet, Na	-	-	-
SCV 46/07	Corvallis	S, Tet, Cf, Na	-	-	-
SCV 52/07	Corvallis	S, Tet, Cf	-	-	-
SCV 61/07	Corvallis	S, Tet, Cf, Tio	-	-	-

Table 4.2.1, continued.

Strains	Serovar	Antibiogram	*int1*	Class 1 Integron	Size (bp)
STM 03/07	Typhimurium	Cf, Na, Lvx	-	-	-
STM 04/07	Typhimurium	S, Tet, Sxt, Cf	-	-	-
STM 06/08	Typhimurium	Amp, C, S, Tet, Gm, K, Sxt, Cf, Tio, Caz, Gat, Na, Amc	+	*dfrA12,aadA2*	1732
STM 07/08	Typhimurium	Tio, Na	-	-	-
STM 30/07	Typhimurium	Tet, Gat	-	-	-
STM 47/07	Typhimurium	Amp, C, S, Tet, Gm, K, Sxt, An, Cf, Gat,Na	-	-	-
STM 48/07	Typhimurium	S, Tet, Cf, Tio, Lvx, Gat, Na	-	-	-
STAN 01/07	Stanley	Tet, Cf, Na	-	-	-
STAN 02/07	Stanley	S, K, Cf	-	-	-
SBR 49/07	Braenderup	Tet, K, Cf, Na	-	-	-
SBR 75/08	Braenderup	S,Tet, Gat	-	-	-
SPB 05/08	Paratyphi B var Java	Amp, C, S, Tet	+	*aadA2*	1000
SPB 06/08	Paratyphi B var Jaya	Amp, C, S, Tet, An	+	*aadA2*	1000
SPB 07/08	Paratyphi B var Jaya	Amp, C, S, Tio	+	*aadA2*	1000
SEP B3	Ependorf	Ce,Cl,Cro,Cxm	-	-	-
SLM B37	Limete	Amp, C, S, Su, Tet, Tm, Sxt, Ce, Cl, Cf, Cip, Na	+	*dfrA1,catB3*	1145
ST 02/08	Typhi	Cf, Na	-	-	-
SMU 31/07	Muenchen	Tet, Na	-	-	-
SBV 56/07	Bovismorbificans	Amp, C, S, Tet, K, Sxt, Cf	+	*dfrA12,aadA2*	1660

Amp, ampicillin; C, chloramphenicol; Tet, tetracycline; S, streptomycin; Su, sulfonamides; An, amikacin; K, kanamycin; Gm, gentamicin, Amc, amoxicillin/clavulanic acid,Tm, trimethoprim; Na, nalidixic acid, Cip, ciprofloxacin; Gat, gatifloxacin; Lvx, levofloxacin; Sxt, trimethoprim-sulfamethoxazole; Ce, cephradine; Cl, cephalexin; Cf, cephalothin; Cxm, cefuroxime; Caz, ceftazidime; Cro, ceftriaxone; Ctx, cefotaxime; Tio, ceftiofur; (+): present; (-): absent

Table 4.2.2: Blast results for class 1 integron for selected MDR *Salmonella* strains

Integrons	Blast results			
	Strains	Serovar	Resistance gene	GenBank Accession No.
1000bp	SPB 06/08	Paratyphi B var Java	*aadA*2	GU 001948.1
1145bp	SLM B37	Limete	*dfrA1, catB3*	AJ 844287.1
1245bp	SAB 53/07	Albany	$bla_{\text{PSE-1}}$	FJ 460234.1
1267bp	SAB B13	Albany	*dfrA1, orfC*	EF 547513.1
1660bp	SBV 56/07	Bovismorbificans	*dfrA12, aadA2*	GU 001949.1
1732bp	STM 06/08	Typhimurium	*dfrA12, aadA2*	GU 001949.1
1821bp	SCV G1	Corvallis	*dfrA12, aadA2*	GU 001949.1

4.3 Detection of SGI1

4.3.1 Detection of Left and Right Junction of SGI1

Among 41strains, left junction with the chromosomal *thdf* gene was detected in eight strains, including *S.* Albany (SAB B13; SAB 53/07; SAB 57/07), *S.* Corvallis (SCV 38/07), *S.* Paratyphi B (SPB 05/08; SPB 06/08; SPB 07/08) and *S.* Limete (SLM B37). The right junction with the chromosomal *yidY* gene was detected in six strains that harbored left junction except SAB 57/07 and SCV 38/07. Besides, negative results were obtained for right junction with the *int2* gene. Representative gels are shown in Figure 4.3.1 and Figure 4.3.2. The occurrence of left and right junction of SGI1 is shown in Table 4.3.1.

After purification, amplified products of SAB 53/07 and SPB 06/08 were sent sequenced for both left and right junction of SGI1 by using primers as described previously (Table 3.4). The results of the DNA sequence data were compared to the data in the GenBank database using BLAST algorithm available at the website (http://blast.ncbi.nlm.nih.gov/Blast.cgi). The BLAST results demonstrated 98% sequence identity to *S.* Typhimurium genomic island 1 with complete sequence (GenBank accession no. AF 261825) which are shown in Table 4.3.2. Thus, these two strains were used as positive control in detecting SGI1.

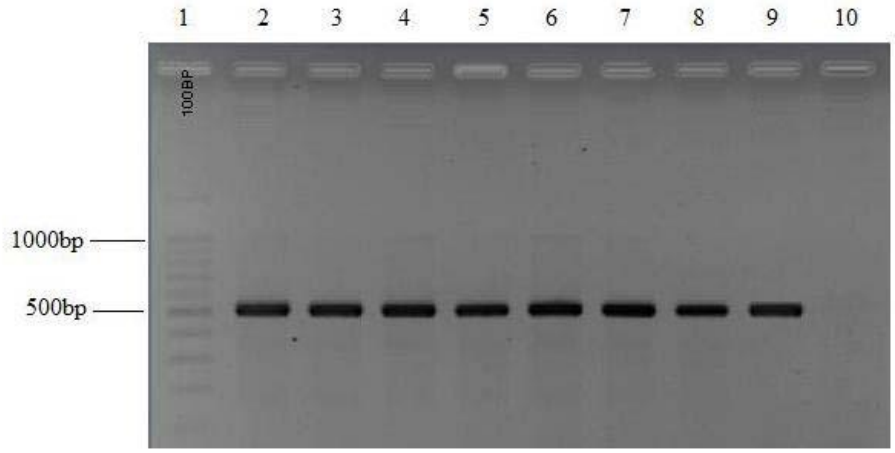

Figure 4.3.1: Representative gel of SGI1 Left Junction detection.

Lane 1: 100bp marker (Promega); lane 2: SPB 05/08;

lane 3: SPB 06/08; lane 4: SPB 07/08; lane 5: SAB 53/07;

lane 6: SAB 57/07; lane 7: SAB B13; lane 8: SLM B37;

lane 9: SCV 38/07; lane 10: Negative control

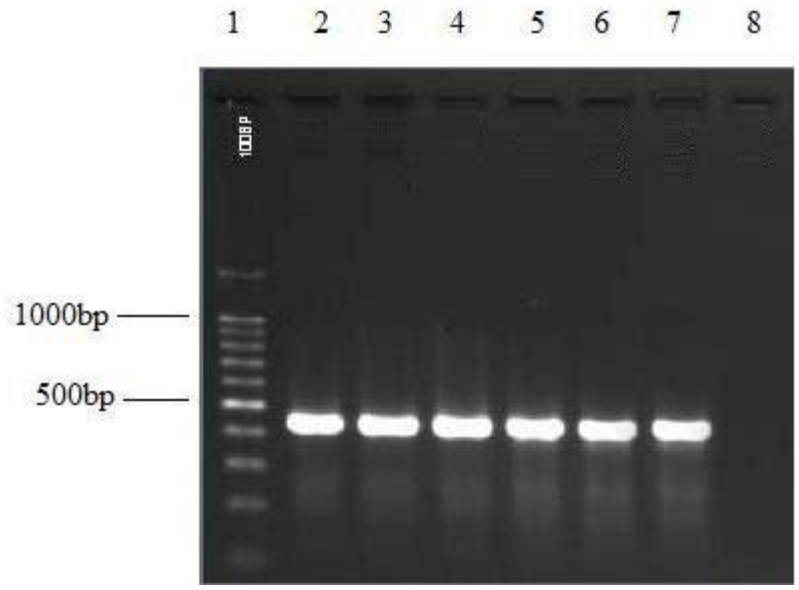

Figure 4.3.2: Representative gel of SGI1 Right Junction detection

Lane 1: 100bp marker (Promega); lane 2: SPB 05/08;

lane 3: SPB 06/08; lane 4: SPB 07/08; lane 5: SAB B13;

lane 6: SAB 53/07; lane 7: SLM B37; lane 8: Negative control

Table 4.3.1: Detection of left and right junction of SGI1 in 6 MDR strains

Strains	Serovar	Antibiogram	SGI 1	
			LJ	RJ
SLG B1	Lagos	Amp,Ce,Cl,Cf,Cro,Cxm,Ctx	-	-
SLG B32	Lagos	Amp, C, S, Su,Gm, K, Tm, Sxt,Cf, Cip, Na	-	-
SE B2	Enteritidis	Tet, Ce, Cl, Cf, Cro, Cxm, Ctx	-	-
SE 16/07	Enteritidis	Amp, Cf, Na	-	-
SE 17/07	Enteritidis	Tet, Cf	-	-
SE 18/07	Enteritidis	Amp, Cf, Tio, Ctx, Caz, Cro, Na	-	-
SE 20/08	Enteritidis	Tet, Cf, Sxt	-	-
SFS B5	Farsta	Amp, C, S, Su, Gm, K, Tm, Sxt, Na	-	-
SFS B36	Farsta	Amp, S, Su, Tet, K, Ce, Cl, Cf, Cxm, Na	-	-
SAB B13	Albany	Amp, C, S, Su,Tet, K, Tm, Sxt, Na	+	+
SAB 53/07	Albany	Amp, C,Tet, Sxt, Cf, Na	+	+
SAB 57/07	Albany	Tet, Sxt, Cf, Na	+	-
SCV G1	Corvallis	Amp, Su, Tet,Tm, Sxt, Cl, Cf, Cxm	-	-
SCV G2	Corvallis	Amp, Su, Tet, Tm, Sxt, Ce, Cl, Cf, Cro, Cxm, Ctx	-	-
SCV B42	Corvallis	S, Su, Tet, Ce, Cl, Cf	-	-
SCV 29/07	Corvallis	S, Tet, Tio,Na	-	-
SCV 33/07	Corvallis	S, Tet, Cip, Na	-	-
SCV 36/07	Corvallis	Amp, S, Tet, Cf, Caz, Tio, Amc	-	-
SCV 38/07	Corvallis	S, Tet, Na	+	-
SCV 46/07	Corvallis	S, Tet, Cf, Na	-	-
SCV 52/07	Corvallis	S, Tet, Cf	-	-

Table 4.3.1, continued.

Strains	Serovar	Antibiogram	SGI 1	
			LJ	RJ
SCV 61/07	Corvallis	S, Tet, Cf, Tio	-	-
STM 03/07	Typhimurium	Cf, Na, Lvx	-	-
STM 04/07	Typhimurium	S, Tet, Sxt, Cf	-	-
STM 06/08	Typhimurium	Amp, C, S, Tet, Gm, K, Sxt, Cf, Tio, Caz, Gat, Na, Amc	-	-
STM 07/08	Typhimurium	Tio, Na	-	-
STM 30/07	Typhimurium	Tet, Gat	-	-
STM 47/07	Typhimurium	Amp, C, S, Tet, Gm, K, Sxt, An, Cf, Gat,Na	-	-
STM 48/07	Typhimurium	S, Tet, Cf, Tio, Lvx, Gat, Na	-	-
STAN 01/07	Stanley	Tet, Cf, Na	-	-
STAN 02/07	Stanley	S, K, Cf	-	-
SBR 49/07	Braenderup	Tet, K, Cf, Na	-	-
SBR 75/08	Braenderup	S,Tet, Gat	-	-
SPB 05/08	Paratyphi B var Java	Amp, C, S, Tet	+	+
SPB 06/08	Paratyphi B var Java	Amp, C, S, Tet, An	+	+
SPB 07/08	Paratyphi B var Java	Amp, C, S, Tio	+	+
SEP B3	Ependorf	Ce,Cl,Cro,Cxm	-	-
SLM B37	Limete	Amp, C, S, Su, Tet, Tm, Sxt, Ce, Cl, Cf, Cip, Na	+	+
ST 02/08	Typhi	Cf, Na	-	-
SMU 31/07	Muenchen	Tet, Na	-	-
SBV 56/07	Bovismorbificans	Amp, C, S, Tet, K, Sxt, Cf	-	-

Amp, ampicillin; C, chloramphenicol; Tet, tetracycline; S, streptomycin; Su, sulfonamides; An, amikacin; K, kanamycin; Gm, gentamicin, Amc, amoxicillin/clavulanic acid,Tm, trimethoprim; Na, nalidixic acid, Cip, ciprofloxacin; Gat, gatifloxacin; Lvx, levofloxacin; Sxt, trimethoprim-sulfamethoxazole; Ce, cephradine; Cl, cephalexin; Cf, cephalothin; Cxm, cefuroxime; Caz, ceftazidime; Cro, ceftriaxone; Ctx, cefotaxime; Tio, ceftiofur; (+): present; (-): absent

Table 4.3.2: Blast results for Left and Right Junction of SGI1 for selected MDR *Salmonella* strains

Strains	Serovar	SGI1	Accession No.
SAB 53/07	Albany	Left junction	AF 261825
SAB 53/07	Albany	Right junction	AF 261825
SPB 06/08	Paratyphi B var Java	Left junction	AF 261825
SPB 06/08	Paratyphi B var Java	Right junction	AF 261825

4.4 Plasmid Profiling

Thirty (73.2%) strains harbored one to eight plasmids each, while no visible plasmid bands can be detected on the others. A total of 23 different plasmid profiles (PPs) ranging from 1.8kb to 65.0kb were obtained (Table 4. 4.1). From the results, plasmid profile 3 (PP3) was represented by three strains while profile 1, 6, 12, 19 and 20 were represented by two strains respectively. The rests of the plasmid profiles were represented by a particular strain for each. Representative gel of plasmid profiling is shown in Figure 4.4.1.

Among the 30 plasmid positive strains, nine strains (30%) harbored only one plasmid (SLG B1, SE 16/07, SE 17/07, SE 18/07, SCV B42, SCV 52/07, STAN 02/07, SPB 05/08, and SBV 56/07), seven strains (23.3%) harbored two plasmids (SLG B32, SFS B5, SFS B36, STM 07/08, STM 30/07, STM 47/07, and STM 48/07), three strains (10%) harbored three plasmids (SE 20/08, SAB 57/07, and SBR 75/08), four strains (13.3%) harbored four plasmids (SCV G1, SCV 38/07, SCV 46/07, and STM 04/07) and four strains (13.3%) harbored five plasmids (SCV 29/07, SCV 33/07, SCV 36/07, and SBR 49/07). Plasmid profiles with 6, 7, and 8 plasmids were detected and obtained in SCV 61/07, SMU 31/07 and STM 06/08, respectively.

Overall, the predominant plasmid was 20.0kb, which can be detected in nine plasmid positive strains, followed by 45.0kb (n=8), 2.8kb (n=6), 5.2kb (n=6), 63.5kb (n=4) and 18.0kb (n=3).

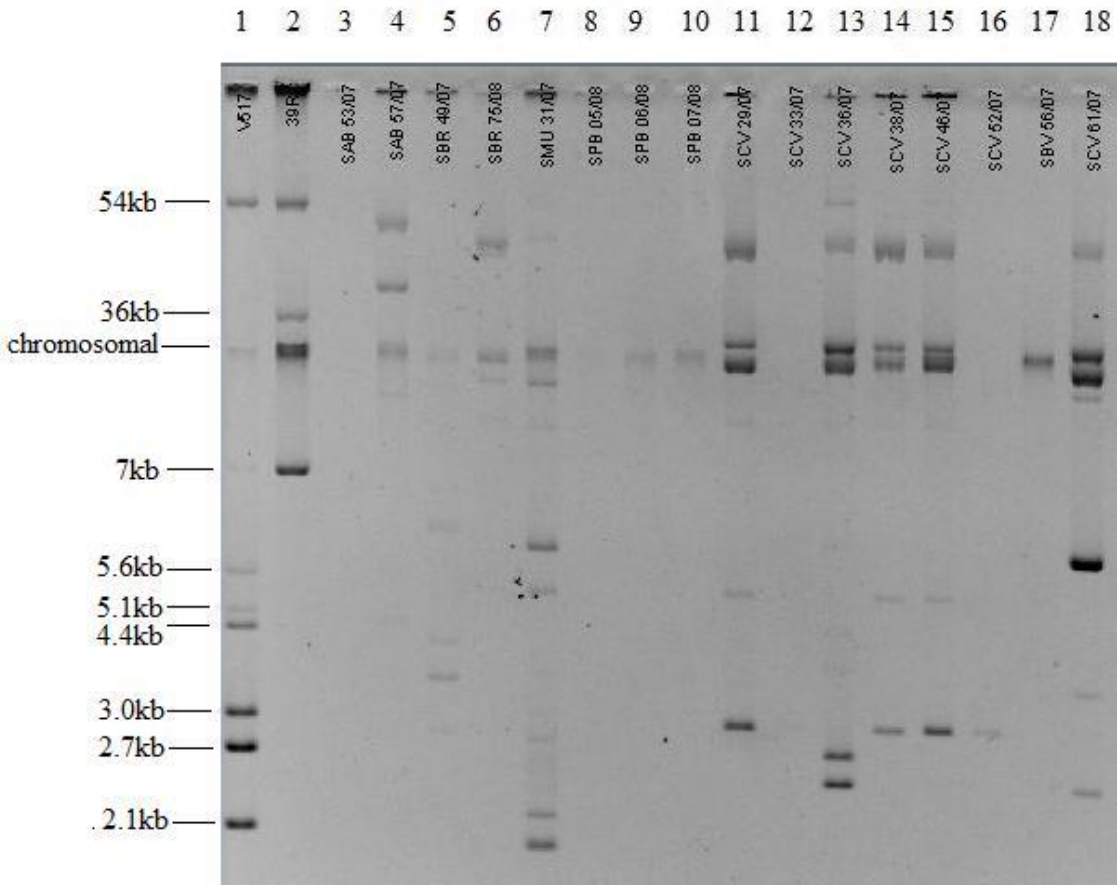

Figure 4.4.1: Representative gel of plasmid profiling of selected MDR *Salmonella* strains

Lane 1: *E. coli* V517 (marker), lane 2: *E. coli* 39R861 (marker);

lane 3: SAB 53/07; lane 4: SAB 57/07; lane 5: SBR 49/07; lane 6: SBR 75/08;

lane 7: SMU 31/07; lane 8: SPB 05/08; lane 9: SPB 06/08; lane 10: SPB 07/08;

lane 11: SCV 29/07; lane 12: SCV 33/07; lane 13: SCV 36/07;

lane 14: SCV 38/07; lane 15: SCV 46/07; lane 16: SCV 52/07;

lane 17: SBV 56/07; lane 18: SCV 61/07

Table 4.4.1: Plasmid profiling of the selected MDR *Salmonella* strains

Strains	Serovar	Antibiogram	Plasmids (kb)	Plasmid Profile
SLG B1	Lagos	Amp,Ce,Cl,Cf,Cro,Cxm,Ctx	20.0	PP1
SLG B32	Lagos	Amp, C, S, Su,Gm, K, Tm, Sxt,Cf, Cip, Na	52.0, 20.0	PP2
SE B2	Enteritidis	Tet, Ce, Cl, Cf, Cro, Cxm, Ctx	-	-
SE 16/07	Enteritidis	Amp, Cf, Na	63.5	PP3
SE 17/07	Enteritidis	Tet, Cf	57.0	PP4
SE 18/07	Enteritidis	Amp, Cf, Tio, Ctx, Caz, Cro, Na	63.5	PP3
SE 20/08	Enteritidis	Tet, Cf, Sxt	63.0, 18.0, 7.0	PP5
SFS B5	Farsta	Amp, C, S, Su, Gm, K, Tm, Sxt, Na	52.0, 22.0	PP6
SFS B36	Farsta	Amp, S, Su, Tet, K, Ce, Cl, Cf, Cxm, Na	52.0, 22.0	PP6
SAB B13	Albany	Amp, C, S, Su,Tet, K, Tm, Sxt, Na	-	-
SAB 53/07	Albany	Amp, C,Tet, Sxt, Cf, Na	-	-
SAB 57/07	Albany	Tet, Sxt, Cf, Na	50.0, 40.0, 12.0	PP7
SCV G1	Corvallis	Amp, Su, Tet,Tm, Sxt, Cl, Cf, Cxm	54.0, 5.2, 4.8, 2.8	PP8
SCV G2	Corvallis	Amp, Su, Tet, Tm, Sxt, Ce, Cl, Cf, Cro, Cxm, Ctx	-	-
SCV B42	Corvallis	S, Su, Tet, Ce, Cl, Cf	63.5	PP3
SCV 29/07	Corvallis	S, Tet, Tio,Na	45.0, 20.0, 10.0, 5.2, 2.8	PP9
SCV 33/07	Corvallis	S, Tet, Cip, Na	45.0, 22.0, 20.0, 5.2, 3.0	PP10
SCV 36/07	Corvallis	Amp, S, Tet, Cf, Caz, Tio, Amc	54.0, 45.0, 20.0, 2.5, 2.3	PP11
SCV 38/07	Corvallis	S, Tet, Na	45.0, 20.0, 5.2, 2.8	PP12

Table 4.4.1, continued.

Strains	Serovar	Antibiogram	Plasmids (kb)	Plasmid Profile
SCV 46/07	Corvallis	S, Tet, Cf, Na	45.0, 20.0, 5.2, 2.8	PP12
SCV 52/07	Corvallis	S, Tet, Cf	2.8	PP13
SCV 61/07	Corvallis	S, Tet, Cf, Tio	45.0, 15.0, 12.0, 5.6, 3.1, 2.3	PP14
STM 03/07	Typhimurium	Cf, Na, Lvx	-	-
STM 04/07	Typhimurium	S, Tet, Sxt, Cf	63.5, 57.0, 20.0, 4.8	PP15
STM 06/08	Typhimurium	Amp, C, S, Tet, Gm, K, Sxt, Cf, Tio, Caz, Gat, Na, Amc	65.0, 47.7, 16.8, 5.9, 5.3, 3.7, 3.1, 2.3	PP16
STM 07/08	Typhimurium	Tio, Na	3.0, 2.2	PP17
STM 30/07	Typhimurium	Tet, Gat	63.0, 45.0	PP18
STM 47/07	Typhimurium	Amp, C, S, Tet, Gm, K, Sxt, An, Cf, Gat,Na	62.0, 36.0	PP19
STM 48/07	Typhimurium	S, Tet, Cf, Tio, Lvx, Gat, Na	62.0, 36.0	PP19
STAN 01/07	Stanley	Tet, Cf, Na	-	-
STAN 02/07	Stanley	S, K, Cf	18.0	PP20
SBR 49/07	Braenderup	Tet, K, Cf, Na	7.0, 6.5, 4.0, 3.6, 2.8	PP21
SBR 75/08	Braenderup	S,Tet, Gat	45.0, 15.0, 10.0	PP22
SPB 05/08	Paratyphi B var Java	Amp, C, S, Tet	18.0	PP20
SPB 06/08	Paratyphi B var Java	Amp, C, S, Tet, An	-	-
SPB 07/08	Paratyphi B var Java	Amp, C, S, Tio	-	-
SEP B3	Ependorf	Ce,Cl,Cro,Cxm	-	-
SLM B37	Limete	Amp, C, S, Su, Tet, Tm, Sxt, Ce, Cl, Cf, Cip, Na	-	-

Table 4.4.1, continued.

Strains	Serovar	Antibiogram	Plasmids (kb)	Plasmid Profile
ST 02/08	Typhi	Cf, Na	-	-
SMU 31/07	Muenchen	Tet, Na	15.0, 10.0, 6.0, 5.2, 2.8, 2.1, 1.8	PP23
SBV 56/07	Bovismorbificans	Amp, C, S, Tet, K, Sxt, Cf	20.0	PP1

Amp, ampicillin; C, chloramphenicol; Tet, tetracycline; S, streptomycin; Su, sulfonamides; An, amikacin; K, kanamycin; Gm, gentamicin, Amc, amoxicillin/clavulanic acid,Tm, trimethoprim; Na, nalidixic acid, Cip, ciprofloxacin; Gat, gatifloxacin; Lvx, levofloxacin; Sxt, trimethoprim-sulfamethoxazole; Ce, cephradine; Cl, cephalexin; Cf, cephalothin; Cxm, cefuroxime; Caz, ceftazidime; Cro, ceftriaxone; Ctx, cefotaxime; Tio, ceftiofur; (+): present; (-): absent

Table 4.4.2: Summary of the genetic elements involved in selected MDR *Salmonella*

Strain	Antibiogram	Resistance genes									Class 1 Integron	SGI 1		Plas-mid
		bla$_{TEM}$	*bla*$_{PSE-1}$	*bla*$_{CMY-2}$	*bla*$_{SHV}$	*bla*$_{CTX-M}$	*bla*$_{OXA-1}$	*qnrA*	*qnrB*	*qnr S*		LJ	RJ	
SLG B1	Amp,Ce,Cl,Cf,Cro,Cxm,Ctx	+	-	-	-	+	-	-	-	-	-	-	-	+
SLG B32	Amp, C, S, Su,Gm, K, Tm, Sxt,Cf, Cip, Na	+	-	-	-	+	-	-	+	+	-	-	-	+
SE B2	Tet, Ce, Cl, Cf, Cro, Cxm, Ctx	-	-	-	-	+	-	-	-	-	-	-	-	-
SE 17/07	Tet, Cf	-	-	-	-	+	-	-	-	-	-	-	-	+
SE 20/08	Tet, Cf, Sxt	-	-	-	+	-	-	-	-	-	-	-	-	+
SE 16/07	Amp, Cf, Na	+	-	-	-	+	-	-	+	-	-	-	-	+
SE 18/07	Amp, Cf, Tio, Ctx, Caz, Cro, Na	+	-	-	-	+	-	-	+	-	-	-	-	+
SFS B5	Amp, C, S, Su, Gm, K, Tm, Sxt, Na	+	-	-	-	+	-	-	+	+	-	-	-	+
SFS B36	Amp, S, Su, Tet, K, Ce, Cl, Cf, Cxm, Na	+	-	+	-	+	-	-	+	+	-	-	-	+
SAB B13	Amp, C, S, Su,Tet, K, Tm, Sxt, Na	-	-	-	-	-	-	-	-	-	+	+	+	-
SAB 53/07	Amp, C,Tet, Sxt, Cf, Na	-	+	-	-	-	-	-	-	-	+	+	+	-
SAB 57/07	Tet, Sxt, Cf, Na	-	-	-	-	-	-	-	+	-	-	+	-	+
SCV G1	Amp, Su, Tet,Tm, Sxt, Cl, Cf, Cxm	-	-	-	-	+	-	-	-	-	+	-	-	+
SCV G2	Amp, Su, Tet, Tm, Sxt, Ce, Cl, Cf, Cro, Cxm, Ctx	-	-	-	-	-	-	-	-	-	-	-	-	-
SCV 36/07	Amp, S, Tet, Cf, Caz, Tio, Amc	-	-	+	-	-	-	-	-	-	-	-	-	+

Table 4.4.2: Continued.

Strain	Antibiogram	Resistance genes									Class 1 Integron	SGI 1		Plas-mid
		bla$_{TEM}$	*bla*$_{PSE-1}$	*bla*$_{CMY-2}$	*bla*$_{SHV}$	*bla*$_{CTX-M}$	*bla*$_{OXA-1}$	*qnrA*	*qnrB*	*qnr S*		LJ	RJ	
SCV B42	S, Su, Tet, Ce, Cl, Cf	-	-	-	-	-	-	-	-	-	-	-	-	+
SCV 52/07	S, Tet, Cf	-	-	-	-	-	-	-	-	-	-	-	-	+
SCV 61/07	S, Tet, Cf, Tio	-	-	-	-	-	-	-	-	-	-	-	-	+
SCV 46/07	S, Tet, Cf, Na	-	-	-	-	-	-	-	+	-	-	-	-	+
SCV 33/07	S, Tet, Cip, Na	-	-	-	-	-	-	-	+	-	-	-	-	+
SCV 29/07	S, Tet, Tio,Na	-	-	-	-	-	-	-	+	+	-	-	-	+
SCV 38/07	S, Tet, Na	-	-	-	-	-	-	-	+	-	-	+	-	+
STM 06/08	Amp, C, S, Tet, Gm, K, Sxt, Cf, Tio, Caz, Gat, Na, Amc	+	-	+	-	-	-	-	+	-	+	-	-	+
STM 47/07	Amp, C, S, Tet, Gm, K, Sxt, An, Cf, Gat,Na	+	-	-	-	+	-	-	+	+	-	-	-	+
STM 03/07	Cf, Na, Lvx	-	-	-	-	-	-	-	-	-	-	-	-	-
STM 04/07	S, Tet, Sxt, Cf	-	-	-	-	-	-	-	-	-	-	-	-	+
STM 48/07	S, Tet, Cf, Tio, Lvx, Gat, Na	-	-	-	-	+	-	-	+	-	-	-	-	+

Table 4.4.2: Continued.

Strain	Antibiogram	Resistance genes									Class 1 Integron	SGI 1		Plas-mid
		bla$_{TEM}$	*bla*$_{PSE-1}$	*bla*$_{CMY-2}$	*bla*$_{SHV}$	*bla*$_{CTX-M}$	*bla*$_{OXA-1}$	*qnrA*	*qnrB*	*qnr S*		LJ	RJ	
STM 07/08	Tio, Na	-	-	-	-	+	-	-	+	+	-	-	-	+
STM 30/07	Tet, Gat	-	-	-	-	-	-	-	+	+	-	-	-	+
STAN 01/07	Tet, Cf, Na	-	-	-	-	-	-	-	-	-	-	-	-	-
STAN 02/07	S, K, Cf	-	-	-	-	-	-	-	-	-	-	-	-	+
SBR 49/07	Tet, K, Cf, Na	-	-	-	-	-	-	-	+	-	-	-	-	+
SBR 75/08	S,Tet, Gat	-	-	-	-	-	-	-	+	-	-	-	-	+
SPB 05/08	Amp, C, S, Tet	-	+	-	-	-	-	-	-	-	+	+	+	+
SPB 06/08	Amp, C, S, Tet, An	-	+	-	-	-	-	-	-	-	+	+	+	-
SPB 07/08	Amp, C, S, Tio	-	+	-	-	-	-	-	-	-	+	+	+	-
SEP B3	Ce,Cl,Cro,Cxm	-	-	-	-	-	-	-	-	-	-	-	-	-
SLM B37	Amp, C, S, Su, Tet, Tm, Sxt, Ce, Cl, Cf, Cip, Na	-	+	-	-	-	-	-	-	-	+	+	+	-
ST 02/08	Cf, Na	-	-	-	-	-	-	-	-	-	-	-	-	-
SMU 31/07	Tet, Na	-	-	-	-	-	-	-	+	-	-	-	-	+
SBV 56/07	Amp, C, S, Tet, K, Sxt, Cf	+	-	-	-	-	-	-	-	-	+	-	-	+

Amp, ampicillin; C, chloramphenicol; Tet, tetracycline; S, streptomycin; Su, sulfonamides; An, amikacin; K, kanamycin; Gm, gentamicin, Amc, amoxicillin/clavulanic acid,Tm, trimethoprim; Na, nalidixic acid, Cip, ciprofloxacin; Gat, gatifloxacin; Lvx, levofloxacin; Sxt, trimethoprim-sulfamethoxazole; Ce, cephradine; Cl, cephalexin; Cf, cephalothin; Cxm, cefuroxime; Caz, ceftazidime; Cro, ceftriaxone; Ctx, cefotaxime; Tio, ceftiofur; (+): present; (-): absent